

Alternative Environmentally Friendly Firefighting Foams



19 May 2004

FY04 Y0817 Program Review

Technical POC

NFESC, Code 421

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Management POC

NFESC, Code 45

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- **To assess and evaluate alternative firefighting foams without perfluorooctyl sulfonate (PFOS) and perfluorooctanoic acid (PFOA) type fluorosurfactants**
- **To demonstrate and validate the performance the candidate fire fighting foam**
- **To coordinate with AFFF Mil Spec custodian (NAVSEA) & approval authorities of services for implementation**

- **Navy's Environmental Quality (EQ) Requirements:**
 - #2.II.01.c, “Control emissions from fire fighter training.”
 - #2.II.01.q, “Control/Treat industrial wastewater discharges.”
 - #3.I.11.j, “Shipboard hazardous materials control and management.”
 - #3.II.04.a, “Non-halon firefighting agents and systems for ships and aircraft.”
- **Air Force Environment, Safety, and Occupational Health (ESOH) Needs:**
 - #1236, “Develop environmentally safe drop-in replacement for halon 1301 used as a fire suppressant for hush houses.”
- **Army Environmental Requirement & Technology Assessments (AERTA) Requirements:**
 - #A(3.4.c), “Alternatives to ozone-depleting firefighting agents.”
- **EQ Requirement Priority: High**

Problem Statement/Regulatory Drivers



- **Current Mil Spec AFFF contains fluorosurfactants, most of that degrade to PFOS and others to PFOA**
- **3M phased-out PFOS-based products in Dec 2002 because PFOS is environmentally persistent, bio-accumulative, and toxic (PBT)**
- **EPA has issued Significant New Use Rule (SNUR) on Perfluoralkyl Sulfonates (PFAS) including PFOS (C8)**
- **Foaming activity causes WWTP disruptions and results in NOVs**
- **High AFFF wastewater disposal costs**
- **Most DoD firefighting trainings do not use AFFF type foams**

- 1. Get early stakeholders & users buy-in and identify first DOD user and their requirements**
- 2. Perform fire hazard analysis (FHA), environmental/hazard and compatibility assessments**
- 3. Develop performance specifications for the identified users**

- **Environmentally friendly firefighting foams**
 - Fluorine-free firefighting agents for Class B fires
 - Environmentally benign (better PBT profile)
 - Equal or close to the existing Mil Spec MIL-F-24385F performance properties
 - Does not contaminate soil, groundwater, storm drains, & waterways
 - Wastewater to be acceptable at WWTPs
 - Compatible with current pumps, proportioners, nozzles, piping, seals, and non-metallic components

Before/After Comparison



	<u>Before</u>	<u>After</u>	<u>Benefits</u>
Fluorinated Surfactants PFOS- & PFOA-type	Yes	No	Compliance
PBT Impacts	High	Low	Compliance
WWTP Impacts (Norfolk only)	High	Low	\$600K/yr
Comply w/EPA SNUR	No	Yes	Compliance
NOV Avoidance	No	Yes	\$25K/day
Training Effectiveness & Readiness	Low	High	Life/property

Milestones and Major Deliverables



Milestones																	
		2002				2003				2004				2005			
ID	Task Name	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
0	Alternative Environmentally Friendly Fire Fighting Foams																
1	Review Mil Spec, environmental and regulatory issues related to the use of AFFF																
2	Develop firefighting performance requirements for liquid fuel fires																
3	Develop test plan and performance parameters																
4	Laboratory tests to establish foam characteristics																
5	Field demonstration for the most promising alternative foam for liquid fuel fires																
6	Prepare performance specifications																
7	Prepare UDP																

Project Coordination



Organizations

Naval Res. Lab.

Air Force Res. Lab.

NAWC, China Lake

**NAVFAC Fire/Emerg.
Service**

Defense Energy Sup. Ctr.

NPTC (CNET)

NAVSEA

EPA

3M Australia

POC

Dr. Ron Sheinson

Mr. Dick Vickers

Mr. Les Bowman

Mr. Carl Glover

Diane Whitney

Rick Dollar

Mr. Doug Barylski

Ms. Mary Dominiak

Mr. Ted Schaefer

Roles

Lab & Field Tests

Field Tests

Field Tests

User

User

Users

MilSpec Custodian

Regulator

Foam Supplier

Technical Accomplishments to Date (FY04)



- **Down-selected a fluorine-free foam developed by 3M Australia**
- **Developed a Field Test Plan with NRL and 3M Australia**
- **Conducted Dem/Val for various fire tests at the facilities supported by 3M Australia**
- **Conducted environmental toxicity tests**
- **Meeting with Carl Glover of NAVFAC HQ Fire and Emergency Services and gained their support as potential user**

Proposed Demonstration/Test Sites



<u>Dem/Val Tests</u>	<u>Sites</u>	<u>Reasons</u>
1. 28, 50, & 1,000 Ft ² FHA tests	3M Australia, NRL	Cost-savings & logistic Support
2. Environmental	NFESC, NRL	Expertise & facilities
3. Hazard Assessment	3M, NRL	Cost-savings & control
4. Compatibility	NRL	Expertise & facilities
5. Final Dem/Val	NRL(CBD) or AFRL, or China Lake	To satisfy user's requirements

Environmental/Toxicity/Compatibility Tests



- **Environmental Tests:**

- BOD/COD
- Activated Sludge
- Acute Toxicity for Daphnia Magna
- Acute Toxicity for Trout
- Growth Inhibition for Green Algae

- **Toxicology Tests:**

- Single Dose Oral Toxicity in Rats
- Acute Eye Irritation in Rabbits
- Acute Primary Dermal Irritation in Rabbits

- **Materials Compatibility Tests:**

- 24 hr Metallic Corrosion Testing as per Def(Aust)5603D
- Metallic Corrosion Testing for 14 Metals by ASTM D1384
- Non-Metallic Corrosion of Nine Materials (Elastomers, Polymers, and Sealants) by NFPA 1150 using ASTM D2240
- Stress Cracking and Cracking of Acrylic Plastics (MIL-P-5425)

Fire Tests Conducted (28 Feb – 12 Mar 04)



	Fire Size	Function	Location
	3.0 sq. ft.	Vapor suppression, and sealability tests	3M Australia, New South Wales
	28 sq. ft.	Per US Mil Spec	Queensland Fire & Rescue Service Training Academy
	50 sq. ft. **	Per US Mil Spec	Same as above
	Processing Unit	Pool fire with multiple obstructions	Same as above
	1076 sq. ft. & 1290 sq. ft.	Pool fire and helicopter simulation	Esso Training Ground Sale, Victoria

3 Ft² Small Scale Fire Test



28 Ft² Fire Test



28 Ft² Fire Test



28 Ft² Fire Test



Pool Fire with Obstructions Fire Test



Helicopter Fire Test



Various Nozzles Used for Fire Test



Foam Spreadability Comparison Tests



Foam Sealability Comparison Tests



Foam Sealability Comparison Tests



Burn-Back Test



Burn-Back Test

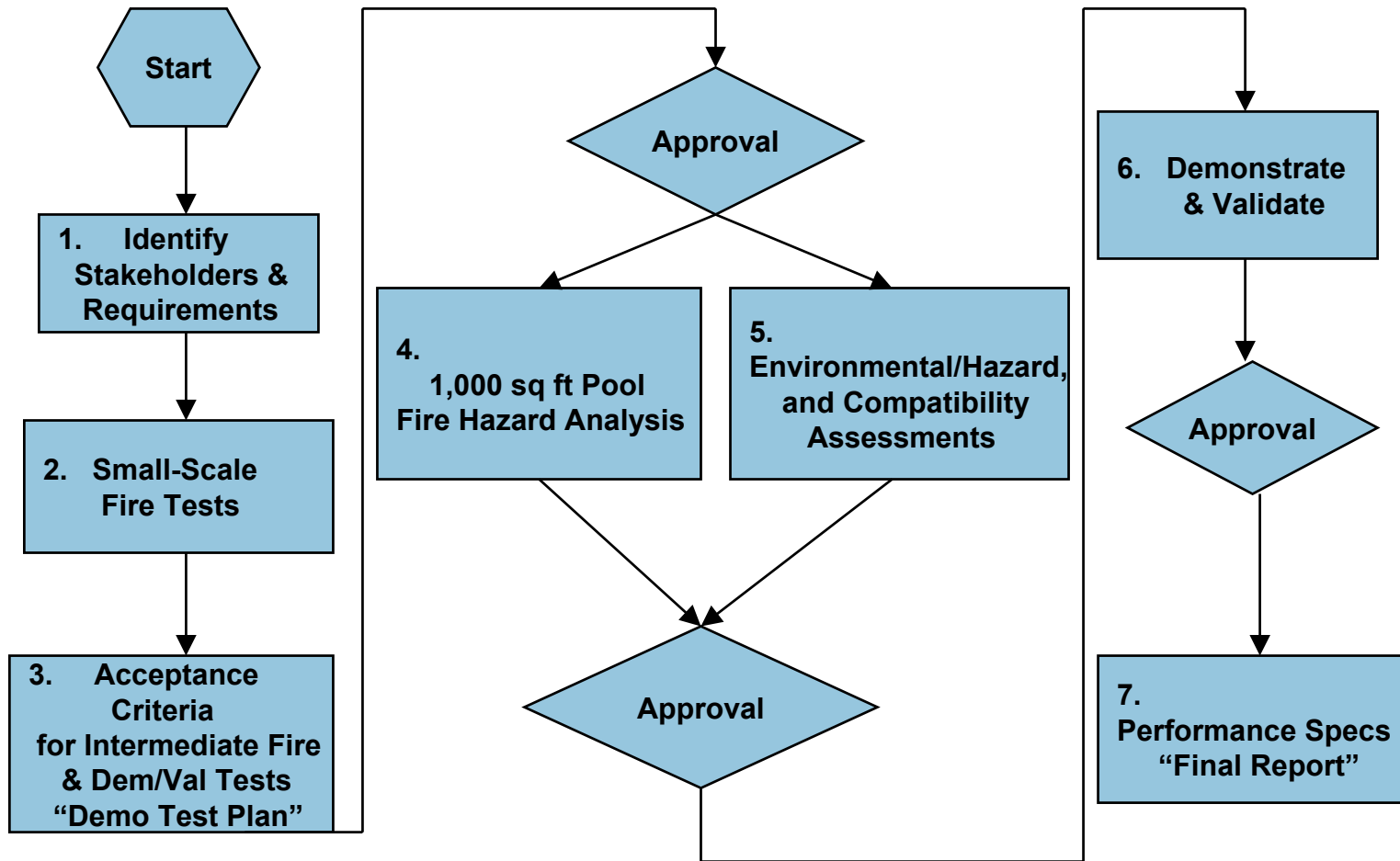


Foamability Test for 3-D Fire



- **Obtained early buy-in from Stakeholder and potential end-users**
- **Identified first DOD user – NAVFAC Fire & Emergency Services in areas of non-ordnance related ashore firefighting applications**
 - Fuel tank fire fighting
 - HAZMAT response
 - Realistic training (using firefighting foam)
- **Obtained support from AFFF Mil Specs PM (Mr. Barylski of NAVSEA Code 05P6) in the area of non-Mil Spec applications**
- **Will work with EPA regulator, Ms. Mary Dominiak, (202)564-8104**
- **Performance specifications will address non-MilSpec user applications**
- **The AFFF Mil Spec (MIL-F-24385F) will not be amended**

Implementation Flow Chart



Logic Model for Environmentally Friendly Firefighting Foams



Navy Benefits	To avoid fluorosurfactant PBT impacts, to provide effective training foam, and to avoid NOVs which will result in \$500K savings for each accident
Customer Capability	To comply with EPA concerns while providing an effective life/property protection and firefighting training
Product	An environmentally Benign firefighting foam as an alternative to AFFF
Project Milestones	MS#5: Field Dem/Val for most promising foam (Q3, FY04) MS#7: Prepare UDP (Q2, FY05)



- To provide an environmentally benign fluorine-free Class B fire fighting foam
- To provide alternative to AFFF for non-ordnance related ashore firefighting applications
- To avoid PBT concerns caused by the existing Mil Spec AFFF
- To avoid NOVs which will result in \$500K savings for each accident